

WHAT IS CLAIMED IS:

1                   1.       A method for processing databases in a system which includes a  
2 plurality of storage areas each storing a database and a plurality of computers each having a  
3 database management program running thereon which manages one of said plurality of  
4 storage areas, each said storage area being associated with only said computer managing said  
5 storage area, said method comprising:

6                   when a failure has occurred in one of said plurality of computers as a failed  
7 computer, obtaining preset substitution information indicating that the storage area managed  
8 by the database management program running on said failed computer is to be managed by  
9 the database management program running on another one of said plurality of computers as a  
10 substitute computer; and

11                  based on said substitution information, changing association of said storage  
12 area with said failed computer to said substitute computer, said storage area to be managed by  
13 said database management program running on said substitute computer.

1                   2.       The method as recited in claim 1, wherein said substitution information  
2 includes association information associating an identifier of said database management  
3 program running on said failed computer with an identifier of said database management  
4 program running on said substitute computer, said substitution information indicating that  
5 said storage area managed by said database management program running on said failed  
6 computer is to be managed by said database management program running on said substitute  
7 computer when a failure occurs.

1                   3.       The method as recited in claim 2, wherein said substitution information  
2 comprises a mutual substitution configuration in which two of the computers are associated  
3 with one another whereby one of the two computers is a substitute computer for the other of  
4 the two computers as a failed computer mutually.

1                   4.       The method as recited in claim 2, wherein said substitution information  
2 comprises a unidirection ring substitution configuration in which a group of the computers  
3 from a first computer to a last computer are associated with each other in a unidirection ring  
4 manner whereby a first computer is a substitute computer for a second computer which is a  
5 substitute computer for a third computer, and the last computer is a substitute computer for  
6 the first computer.

1                   5.       The method as recited in claim 2, wherein said substitution information  
2 comprises an n-to-1 substitution configuration whereby one of the computers is a substitute  
3 computer for n of the computers as failed computers.

1                   6.       The method as recited in claim 1, wherein said substitution information  
2 includes a plurality of pieces of association information each associating an identifier of said  
3 database management program running on said failed computer, an identifier of the database  
4 management program running on one of a plurality of substitute computers, and priority  
5 information indicating a priority with one another, said substitution information indicating  
6 that said storage area managed by said database management program running on said failed  
7 computer is to be managed by said database management program running on one of said  
8 substitute computers selected according to said priority information.

1                   7.       The method as recited in claim 1, further comprising taking over  
2 processing from said failed computer by said substitute computer based on said substitution  
3 information.

1                   8.       A method for processing a database in a database management system  
2 which divides said database into a plurality of sub-databases and associates each sub-database  
3 with one of a plurality of database servers to process data, said method comprising:

4                   if one of said plurality of database servers is found to have failed as a failed  
5 database server when a request for processing is made to said failed database server,  
6 obtaining an identifier of another one of said plurality of database servers as a substitute  
7 database server which is to take over said processing from said failed database server based  
8 on information on substitution relations between said plurality of database servers, and  
9 switching from said failed database server to said substitute database server for receiving said  
10 request for said processing;

11                  wherein said information on substitution relations between said plurality of  
12 database servers indicating which one of said plurality of database servers is used as a  
13 substitute database server if one of the other database servers fails is stored beforehand.

1                   9.       The method as recited in claim 8, further comprising:  
2 receiving said request to which a substitution instruction based on said  
3 information on substitution relations has been added upon a failure of said failed database;  
4 and

5 recognizing said substitution instruction and performing said processing in  
6 place of said failed database server based on said recognized substitution instruction.

1 10. The method as recited in claim 9, further comprising, before  
2 performing said processing in place of said failed database server, changing an execution  
3 environment of said substitute database server to an execution environment of said failed  
4 database server, said substitute database server taking over said processing.

1 11. The method as recited in claim 9, wherein performing said processing  
2 in place of said failed database server comprises using a database buffer of the substitute  
3 computer for accessing a database storage area, a table, or an index associated with said  
4 failed database server.

1 12. A system for processing databases, said system comprising:  
2 a plurality of storage areas each storing a database; and  
3 a plurality of computers each having a database management program running  
4 thereon which manages one of said plurality of storage areas, each said storage area being  
5 associated with only said computer managing said storage area;  
6 wherein each computer includes a substitution control section configured,  
7 when a failure has occurred in one of said plurality of computers as a failed computer, to  
8 obtain preset substitution information indicating that the storage area managed by the  
9 database management program running on said failed computer is to be managed by the  
10 database management program running on another one of said plurality of computers as a  
11 substitute computer; and, based on said substitution information, to change association of said  
12 storage area with said failed computer to said substitute computer, said storage area to be  
13 managed by said database management program running on said substitute computer.

1 13. The system as recited in claim 12, wherein said substitution  
2 information includes association information associating an identifier of said database  
3 management program running on said failed computer with an identifier of said database  
4 management program running on said substitute computer, said substitution information  
5 indicating that said storage area managed by said database management program running on  
6 said failed computer is to be managed by said database management program running on said  
7 substitute computer when a failure occurs.

1                   14.     The system as recited in claim 13, wherein said substitution  
2 information comprises a mutual substitution configuration in which two of the computers are  
3 associated with one another whereby one of the two computers is a substitute computer for  
4 the other of the two computers as a failed computer mutually.

1                   15.     The system as recited in claim 13, wherein said substitution  
2 information comprises a unidirection ring substitution configuration in which a group of the  
3 computers from a first computer to a last computer are associated with each other in a  
4 unidirection ring manner whereby a first computer is a substitute computer for a second  
5 computer which is a substitute computer for a third computer, and the last computer is a  
6 substitute computer for the first computer.

1                   16.     The system as recited in claim 13, wherein said substitution  
2 information comprises an n-to-1 substitution configuration whereby one of the computers is a  
3 substitute computer for n of the computers as failed computers.

1                   17.     The system as recited in claim 12, wherein said substitution  
2 information includes a plurality of pieces of association information each associating an  
3 identifier of said database management program running on said failed computer, an  
4 identifier of the database management program running on one of a plurality of substitute  
5 computers, and priority information indicating a priority with one another, said substitution  
6 information indicating that said storage area managed by said database management program  
7 running on said failed computer is to be managed by said database management program  
8 running on one of said substitute computers selected according to said priority information.

1                   18.     The system as recited in claim 12, wherein the substitution control  
2 section of said substitute computer is configured to take over processing from said failed  
3 computer based on said substitution information.

1                   19.     A system for processing databases, said system comprising:  
2                   a plurality of storage areas each storing a database; and  
3                   a plurality of computers each having a database management program running  
4 thereon which manages one of said plurality of storage areas, each said storage area being  
5 associated with only said computer managing said storage area;

6                    wherein each computer includes a substitution control section configured, if  
7 one of said plurality of database servers is found to have failed as a failed database server  
8 when a request for processing is made to said failed database server, to obtain an identifier of  
9 another one of said plurality of database servers as a substitute database server which is to  
10 take over said processing from said failed database server based on information on  
11 substitution relations between said plurality of database servers, and switching from said  
12 failed database server to said substitute database server for receiving said request for said  
13 processing; and

14                    wherein said information on substitution relations between said plurality of  
15 database servers indicating which one of said plurality of database servers is used as a  
16 substitute database server if one of the other database servers fails is stored beforehand.

1                    20.     The system as recited in claim 19, further comprising a  
2 communications control apparatus configured to receive said request to which a substitution  
3 instruction based on said information on substitution relations has been added upon a failure  
4 of said failed database; and wherein said substitution control section is configured to  
5 recognize said substitution instruction and perform said processing in place of said failed  
6 database server based on said recognized substitution instruction.

1                    21.     The system as recited in claim 20, wherein said substitution control  
2 section is configured to change an execution environment of said substitute database server to  
3 an execution environment of said failed database server before performing said processing in  
4 place of said failed database server.

1                    22.     The system as recited in claim 20, wherein said substitution control  
2 section is configured to use a database buffer of the substitute computer for accessing a  
3 database storage area, a table, or an index associated with said failed database server.

1                    23.     The system as recited in claim 20, further comprising a processing  
2 request receiving device configured, if one of said plurality of database servers is found to  
3 have failed as a failed database server when a request for processing is made to said failed  
4 database server, to add a substitution instruction to said request for processing based on said  
5 information on substitution relations, before sending said request for processing to said  
6 computers.

1                   24.     In a computer readable medium storing a program for processing  
2     databases in a system which includes a storage area storing said database and a plurality of  
3     computers each having a database management program running thereon which manages said  
4     storage area, each said storage area being associated with only said computer managing said  
5     storage area, the program comprising:

6                   code for, when a failure has occurred in one of said plurality of computers as a  
7     failed computer, obtaining preset substitution information indicating that the storage area  
8     managed by the database management program running on said failed computer is to be  
9     managed by the database management program running on another one of said plurality of  
10    computers as a substitute computer; and

11                  code for, based on said substitution information, changing association of said  
12    storage area with said failed computer to said substitute computer, said storage area to be  
13    managed by said database management program running on said substitute computer.

1                   25.     The program as recited in claim 24, wherein said substitution  
2     information includes association information associating an identifier of said database  
3     management program running on said failed computer with an identifier of said database  
4     management program running on said substitute computer, said substitution information  
5     indicating that said storage area managed by said database management program running on  
6     said failed computer is to be managed by said database management program running on said  
7     substitute computer when a failure occurs.

1                   26.     The program as recited in claim 24, wherein said substitution  
2     information includes a plurality of pieces of association information each associating an  
3     identifier of said database management program running on said failed computer, an  
4     identifier of the database management program running on one of a plurality of substitute  
5     computers, and priority information indicating a priority with one another, said substitution  
6     information indicating that said storage area managed by said database management program  
7     running on said failed computer is to be managed by said database management program  
8     running on one of said substitute computers selected according to said priority information.

1                   27.     The program as recited in claim 24, further comprising code for taking  
2     over processing from said failed computer by said substitute computer based on said  
3     substitution information.

1                   28.     The program as recited in claim 27, further comprising:  
2                   code for receiving said request to which a substitution instruction based on  
3     said information on substitution relations has been added upon a failure of said failed  
4     database; and

5                   code for recognizing said substitution instruction and performing said  
6     processing in place of said failed database server based on said recognized substitution  
7     instruction.

1                   29.     The program as recited in claim 28, further comprising code for, before  
2     performing said processing in place of said failed database server, changing an execution  
3     environment of said substitute database server to an execution environment of said failed  
4     database server, said substitute database server taking over said processing.

1                   30.     The program as recited in claim 28, wherein said code for performing  
2     said processing in place of said failed database server comprises code for using a database  
3     buffer of the substitute computer for accessing a database storage area, a table, or an index  
4     associated with said failed database server.

1                   31.     A system for processing databases, said system comprising:  
2                   a plurality of storage areas each storing a database;  
3                   a plurality of computers each having a database management program running  
4     thereon which manages one of said plurality of storage areas, each said storage area being  
5     associated with only said computer managing said storage area; and  
6                   a management system coupled with the plurality of computers;  
7                   wherein the management system is configured to determine whether a failure  
8     has occurred in one of said plurality of computers as a failed computer; and, if a failure has  
9     occurred, to obtain preset substitution information indicating that the storage area managed  
10    by the database management program running on said failed computer is to be managed by  
11    the database management program running on another one of said plurality of computers as a  
12    substitute computer; and

13                  wherein each computer is configured, when a failure has occurred in one of  
14    said plurality of computers as a failed computer, to obtain the preset substitution information  
15    from the management system; and, based on said substitution information, to change  
16    association of said storage area with said failed computer to said substitute computer, said

17 storage area to be managed by said database management program running on said substitute  
18 computer.

1                   32.     The system as recited in claim 31, wherein said management system is  
2 configured to send a request for processing including accessing a storage area; and wherein,  
3 if the computer associated with the storage area to be accessed is the failed computer, the  
4 management system is configured to add a substitution instruction to the request based on  
5 said preset substitution information.

1                   33.     The system as recited in claim 32, wherein said substitute computer is  
2 configured, upon receiving said request from said management system with said substitution  
3 instruction, to change an execution environment of said substitute computer to an execution  
4 environment of said failed computer before performing said processing in place of said failed  
5 computer.